

Practical and Efficient Sterilization of Materials for Private Operations—the Finished Portable Sterilizer

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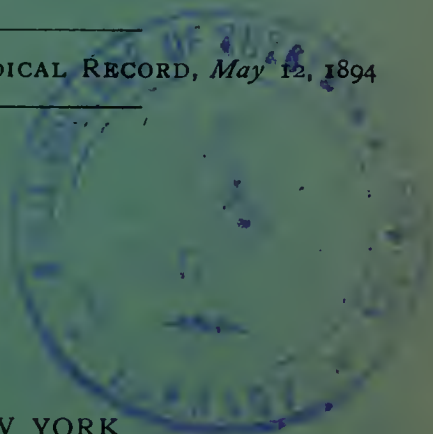
BY

WILLY MEYER, M.D.

NEW YORK

PROFESSOR OF SURGERY AT THE POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL,
ATTENDING SURGEON TO THE GERMAN AND NEW YORK
SKIN AND CANCER HOSPITALS

Reprinted from the MEDICAL RECORD, May 12, 1894



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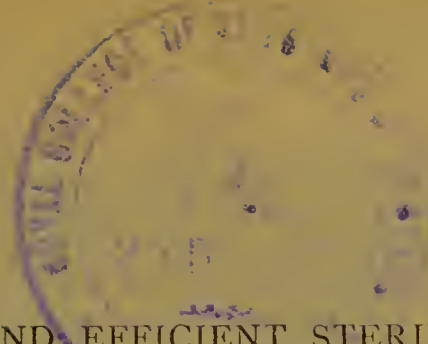


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PRACTICAL AND EFFICIENT STERILIZATION
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ILIZER.¹

PRACTICAL and efficient sterilization of materials for private operations may be divided into two classes, according to the doctors who make use of it.

I. Sterilization in the hands of those who prefer to always render materials aseptic “at their own home,” and then take it along in their satchel prepared for the operation.

II. Sterilization by those who also prepare the materials which are to come in immediate contact with the wound “at the patient’s home,” immediately before the operation.

I. Sterilization at home. How can these doctors proceed?

1. Boiling.

Instruments: They can boil their instruments for five minutes in any vessel: pot, fish-boiler, Rotter’s apparatus, etc., according to their convenience. They will use a 1 to 1½ per cent. soda solution. This is the only recommendable and proper method of sterilizing instruments.²

Gauze, silk, drainage-tubes, etc. :

If they have more time at their disposal and do not

¹ Read before the Section on General Surgery of the New York Academy of Medicine, March 12, 1894.

² Knives do not stand boiling for any length of time. Their edge becomes dull at once. A few seconds’ boiling will suffice to destroy the ordinary infectious cocci. Knives should be rubbed with a piece of sterilized gauze which has been soaked in alcohol or ether. Besides this, their blades might be dipped for a few moments into the boiling soda solution.

want to buy a sterilizer, they may even "boil" at home the gauze which had been cut before and folded into compresses of proper size. They will do this in plain water, or better, perhaps, also in a 1 to 1½ per cent. soda solution, in an ordinary clean pot for half an hour. Then the gauze is dried. It will be reliably aseptic beyond doubt. But the boiled and dried gauze has lost a good deal of its original softness and pliability. It is less absorbent. Silk or linen-thread rolled on glass-spools may be boiled for half an hour in a five per cent. solution of carbolic acid or one per cent. soda solution, and then preserved in alcohol. Rubber drainage-tubes should be boiled in soda solution and then preserved in an antiseptic lotion.

The procedure of sterilizing material for the dressing in boiling water is extremely time robbing. We therefore will rarely find the method of boiling used in private practice for the sake of rendering aseptic anything else than the instruments, silk (antiseptic preparation), and drainage-tubes.

2. Dry heat.

Can the doctor who prepares his materials at home use dry heat for his purposes? Will it be practicable for him to, as it is often called, "bake" his instruments, gauze, etc.? I believe not. Experiments of Robert Koch, of Berlin, made in 1880, have demonstrated:

(1.) Ordinary cocci are destroyed in a temperature of a little more than 212° F. (100° C.) after an hour and a half; a temperature of 284° F. (140° C.) is needed for three hours, and one of 302° to 356° F. (150° to 180° C.) for two hours, in order to kill anthrax spores. (2.) Objects exposed to hot air in an apparatus are unequally penetrated by the same. A small bundle of clothes, for instance, was found not to be thoroughly disinfected after having been baked in a temperature of 284° F. for three to four hours. (3.) Almost every sort of material is more or less damaged by this mode of disinfecting.

It is further a well-known fact that our instruments are

spoiled by the repeated effect of the intense dry heat ; they become forever soft and dull (steel-iron is changed into rod-iron) ; they also rust. Dry-heat sterilization has been a failure, and therefore lost its place in practical surgery. There is only one exception, viz , the preparation of catgut. The chemical sterilization of catgut is tedious. It takes two and a half days, twenty-four hours in ether or benzine, twelve hours in alcohol, twenty four hours in sublimate water (not in sublimate alcohol), 1 to 1,000 ; preserve in alcohol. In hot air of 302° F. (150° C.) it can be reliably rendered aseptic in forty-five minutes (Braatz). The process takes practically an hour and a half, as the apparatus needs three-quarters of an hour before getting up a temperature of 302° F. Of course a special apparatus is needed for the purpose. Braatz has constructed a very handy one. He first extracts the fat of the gut with ether. I am able, through the courtesy of Messrs. R Kny & Co., of this city, to demonstrate the apparatus devised by Braatz here to-night.¹ (Demonstration.) The gut is best rolled on glass spools before sterilization, and then preserved either dry in special small metal boxes constructed for the purpose² or, perhaps, more practically for private use, in alcohol.

I am indebted to Dr. Edebohls, of this city, for calling my attention to a small-sized, not portable, sterilizer, which had been recommended to him as very practical by Dr. Max Schüller, of Berlin.³ It is here before you to-night. The apparatus can be used for sterilization by steam and dry heat. In it the catgut is put as bought, rolled on glass spools, and the fat is not extracted first. Yet the material is absolutely sterilized after three to four hours, as Dr. Edebohls asserts.

In all other respects dry-heat sterilization—baking—has to be given up in practical surgery on account of its

¹ It is made by Schmucker, of Heidelberg. See E. Braatz, *Grundlagen der Aseptik*, p. 29.

² Braatz : l. c., p. 31.

³ Manufacturer : E. A. Lentz, Berlin, 36 and 37 Spandauer St. See Catalogue, No. II. ; Abtheilung III., 1893, pp. 108 and 109.

being an unreliable, time-robbing, and (to the material) harmful procedure, and infinitely inferior to the third method of sterilization which the doctor can make use of at home :

3. Steaming.

Any reliable apparatus can be used. For surgeons and gynecologists that of Braatz,¹ or the one made by Lentz, of Berlin, mentioned above, deserve recommendation. The one recently devised by Boeckmann, of St. Paul² also seems to be quite practical.

The cheap Arnold sterilizer will receive all the materials which come directly in contact with the wound, and, moreover, aprons. The apparatus does not permit of boiling the instruments, however. Another vessel must be used for this purpose. (Instruments should never be steamed, because they rust; the procedure also consumes an unnecessary long time—twenty to thirty minutes.) If my portable sterilizer be on hand, aseptical preparation of everything needed (catgut excepted) will take half an hour. Of course the materials having been steamed can be left in those sterilizers, which are portable (Arnold's, author's), and carried in and with them to the patient's home, ready for use.

If you ask me, Mr. Chairman and Gentlemen, "Is sterilization at the doctor's home efficient, without using a portable apparatus?" I have, of course, to say: It is, provided gauze, drainage-tubes, silk, cotton, etc., are first specially and tightly wrapped in a piece of gauze or a towel held by pins, and thus put into the sterilizer. Afterward everything must be transferred "within the same cover" into the doctor's satchel, which is opened at the patient's house only, after proper disinfection of the hands. Or the material has to be carried along in the metallic perforated trays which had received it for the act of sterilizing, and are now, for the sake of transportation, surrounded by a leather- or canvass-cover with handle. If this care were not taken, the doctor always had to thor-

¹ L. c., p. 62.

² New York MEDICAL RECORD, 1894, No. 1, p. 30.

oughly disinfect his hands at home before handling the material lest contamination should take place. Since we know that air-infection is practically *nil*, and that contact infection means everything, we have to lay more stress on the reliably aseptic condition of all material which is going to come in contact with the wound in the course of the operation, besides fully disinfecting our hands. The latter can never be done too carefully. A doctor who is careless in this respect, before and during the operation, is bound to have failure after failure, even with the most perfect sterilization of all the materials.

If you ask me, "Is it practical for a doctor to always sterilize materials for private operations at his home, and then to carry it with him in his satchel?" I decidedly answer, No.¹ It means, to say the least, a waste of time, and is apt to prevent a rapid introduction of aseptic surgery in private practice on account of complicating the procedure. If he employs a private nurse who has charge of all the preparations for the operations, this point may be less important. And yet, if the package containing gauze or anything else should drop on the floor at the patient's home, what then? Or if one or the other instrument drops down, and a clean vessel for re-boiling is just not at hand? I believe that doctor would at the next occasion do what is preferred by the second class of operating physicians, namely :

II. To have a sterilizer, which also permits of rendering aseptic the materials which are to come in immediate contact with the wound, "at the patient's home," immediately before the operation, which is, in one word, "portable."

According to my opinion a portable sterilizer should answer the following purposes :

¹ With reference to silk or linen thread, a "specialist" who is going to do a more serious operation—intra-abdominal, resection of joints or bones, amputation, etc.—will do best to attend to the preparation of the necessary different sizes at home and take them with him (as the catgut) ready for use. Yet it can, if wanted, always be thoroughly sterilized immediately before the operation within the same apparatus.

1. It must be portable, that is to say, not too clumsy, not too heavy, yet large enough to receive the longest instruments in use. For the sake of easy transportation an ordinary canvas cover, with round leather handle, or, if wanted, a more elegant leather-case, will prove very convenient.

2. It must permit of sterilizing everything needed for the operation as such (instruments *and* materials [catgut excepted]) within the same apparatus.

3. It must be practical, that is to say, it must contain everything necessary for sterilization within itself.

Therefore :

a. It must have its own lamp.

b. It must be constructed on the assumption that warm water is not always at hand at the patient's home.

c. Measuring of the necessary amount of alcohol for the lamp and of water for the apparatus must be avoided.

d. The sterilizer must do effective and reliable work in as short a time as possible, and without needing attention with reference to the proper time; in other words, it must as far as possible be "self acting."

Has a sterilizer of this kind hitherto been at our disposal? I believe not.¹ The one constructed by myself which I shall afterward take pleasure in demonstrating once more before the Section,² according to the suggestion and request of our esteemed Chairman and Secretary,

¹ As mentioned above, the rather clumsy, round Arnold sterilizer, which is of inferior make, can be put in a cover, with handle, and thus made portable. But instruments cannot be boiled in it. Another vessel is needed for this purpose. It is made of tin, which easily rusts. Its use requires timing the act of sterilizing. The so-called "Van Heusen's Compress Heater and Sterilizer" is, in its present shape, not recommendable for the use of the operating physician as a portable apparatus. The tray of its largest size is too small to receive all the material that is needed for a major operation; instruments cannot be boiled in it; if wanted, only a few would be received, and have to be fished later out of the hot water in the dark; instruments would have to boil during the entire act of sterilization, as the small tank containing the water cannot be lifted out and replaced at will; the apparatus also requires timing.

² See Meeting of the Surgical Section, of January 8, 1894, MEDICAL RECORD, February 24, 1894, p. 252.

seems to fulfil the above requirements. It is, I believe, practical and worthy of a thorough trial. It will be of special value in operating out of town.

Before showing the apparatus in its present finished shape I have to answer two questions: 1. How many minutes are actually required to thoroughly sterilize gauze, etc., in a portable, that is, in a not very large apparatus? 2. Is it an essential feature of sterilization to warm the materials before and after the procedure (so called "Vor-und Nach-waermen" (Schimmelbusch))?

First question: How many minutes are actually required to thoroughly sterilize gauze, etc., in a portable, that is, in a not very large apparatus?

Answer: The strictest proof would be given in the following manner: Let anthrax spores dry on a woollen or cotton thread; wrap it in a few yards of gauze, this again in a towel as tightly as possible; put it at the bottom of the tray for the materials to be sterilized; make out after how many minutes the spores are destroyed. I had neither time nor opportunity to try this with my sterilizer, and believe the experiment to be superfluous, since Schimmelbusch has made the same with a small-sized apparatus of his own device. In it the steam also is generated, as in my sterilizer, from boiling soda solution, which boils at about 219° F. (104° C.). He found, in experiments with reference to killing anthrax spores and disinfecting dressing materials which had been saturated with pus, certain death to all micro-organisms within fifteen minutes in every instance. Without giving reasons for it, he nevertheless puts thirty minutes as the proper time for sterilizing gauze in his apparatus. Braatz remarks, in explaining the proper handling of his portable sterilizer: ¹ "All objects to be sterilized by steam are left in the same for about twenty minutes, counting from the moment the water boils thoroughly." And on p. 139 he says: "The objects remain in the apparatus for half an hour, in the small pot (p. 135) at least one quarter of

¹ Grundlagen der Aseptik, p. 65.

an hour after steam is in full generation. Then everything is absolutely sterile and more trustworthy than it might be accomplished with a strong antiseptic in days, with a five per cent. carbolic solution in weeks." Fifteen to twenty minutes, therefore, is the time which is absolutely needed to completely sterilize the materials for an operation in a comparatively small-sized (portable) sterilizer. In my sterilizer twenty-four minutes are given to thorough steaming if two quarts of cold water be poured into the kettle. If hot water be on hand and can be made use of at once when starting the apparatus, anxious minds will be able to increase the time for sterilizing to twenty-eight till twenty-nine minutes.

Second question: Is it an essential feature of sterilization to warm the materials before and after the procedure?

Answer: Not at all. Erwin von Esmarch has shown by careful experiments (1888), that the disinfecting power of the steam is increased in proportion to its moisture. Warming the material, before it is reached by the steam, is therefore not only unnecessary, but actually reduces the disinfecting power of the steam. This in its principal wrong construction (primary warming) is also found in the well-known Lautenschlaeger's steam-sterilizer. Too much stress, furthermore, has been wrongly laid upon the necessity of a dry condition of the steamed (aseptic) gauze, "the drying after steaming." Aseptic (steamed) gauze, which, say, is moistened by some condensed steam, is absolutely harmless and perfectly reliable. The direct application of moistened steamed gauze to a wound will certainly never involve a risk for the patient. Nevertheless we can try to prevent moistening the superficial layers of the gauze in a portable sterilizer, and can easily do so by spreading a towel on top of the material, in order to prevent dripping of some condensed water from the lower aspect of the lid.¹ What we have to emphasize

¹ It will be found in trying my sterilizer that even without spreading the towel on top, the gauze, immediately after sterilization, is not at all moist, but, as it is called, "steam-moist." As soon as it is taken

however, is this: The dictum that preliminary and after-warming of the gauze is "a material factor" in properly sterilizing the same, is wrong and untenable. It tends to obstruct simplifying aseptic surgery.¹

Additional points of my finished portable sterilizer which deserve mentioning in comparison to the one described in the *MEDICAL RECORD* of March 3d are:

1. The Bunsen burners are wider. The quantity of alcohol consumed in one half hour is a little increased for this reason, = 420 c.c. (14 ounces), instead of 400 c.c. Its lid has a movable wire handle on its upper, and a cover of pressed asbestos on its lower aspect. This permits to extinguish the lamp at will with absolute ease and safety.

2. The stand is made of galvanized iron. It will thus be less easily blackened by the flame.

3. Each apparatus contains a plate of pressed asbestos, which could absorb all the 420 c.c. of alcohol. The plate is put underneath the lamp. With it sterilization may be done on a polished mahogany table without causing any damage to the same.

4. The lid of the outside kettle fits more tightly. The continuous slight loss of steam is thus greatly reduced.

In conclusion, I want to draw the attention of the profession to an important question. It is all right and good, also profitable, that the operating physician should have a sterilizer of his own, portable or not, as he may prefer. But how about the general practitioner? Provided he wants to do aseptic work, must he also buy such an apparatus, or must he continue to attend his cases according to the antiseptic method? Further: Shall the specialist in operating on minor private cases always carry his sterilizer with him, or take the trouble and sterilize his wrapped-up material at his home? Decidedly not! What we need, and shall certainly have within the out of the apparatus the rest of the steam evaporates and the gauze is perfectly dry.

¹ Follows demonstration of the author's portable sterilizer. See *MEDICAL RECORD*, March 3, 1894, p. 285.

nearest future, is the assistance of aseptically well-trained and reliable druggists, who keep aseptic surgical material in stock. This point has been specially emphasized by Braatz.¹ There are already a few drug firms here in this city who sell aseptically prepared reliable material. They have aseptic catgut, silk, and silkworm-gut; they have antiseptically prepared drainage-tubes. But, as far as I have seen by personal inspection, they only keep "boiled" aseptic gauze, their cotton is made in factories borated, etc.; gauze sponges cannot be had.

What we doctors have to do is, to induce enterprising druggists, to sterilize the material for doctors as well as patients, according to the newest principles, on the wholesale plan. And the druggists will be almost forced to have reliable "aseptic" material for sale as the doctors will, no doubt, henceforth prescribe less and less "antiseptic" material.² The druggist can easily have constructed perforated cylindrical trays, made of tin or glass, which hold about three to five yards of gauze cut and folded, or one-fourth pound of cotton, and can be closed after sterilization by simply turning a second surrounding imperforated capsule. Or the perforated cylinder is put in a second solid tin or glass capsule. The cylinders are sterilized packed with the gauze.

As soon as this is accomplished, asepticism will also be used in minor surgery, and surgical patients who naturally come under the care of the general practitioner can also enjoy the blessings of the new "aseptic era."

¹ Follows demonstration of the author's portable sterilizer. See *MEDICAL RECORD*, March 3, 1894, p. 285.

² The only antiseptic gauze which will always remain in use and be useful is iodoform gauze. If ready made, it cannot be sterilized by steam because iodoform is decomposed by the process. In order to do away with the iodoform gauze prepared in factories it will be preferable (in cases where we have to use (tamponade in mouth, nose, rectum, etc.) or want to use material containing this splendid antiseptic) to take steamed gauze and powder iodoform in it, or to sprinkle the steamed gauze with boiled water and rub in the powder with a piece of sterile gauze.